Integrating the Indiana Workforce into the Wind Industry

WINDIANA CONFERENCE,

JULY 22, 2010

Amatrol Background…..

- Based in Jeffersonville, Indiana
- 1965 - Original mission design and manufacture industrial automation systems
- 1981 - Educational Division founded to develop quality teaching systems for automation and engineering

AMATROL'S PRIMARY MISSION – A SKILLS BASED CURRICULUM

- Design and manufacture Training Systems for industrial skills
- Provide turnkey training/teaching solutions with curriculum and hardware
- Replicate truly industrial application functions using industry standard components

AMATROL'S PRIMARY MISSION – A SKILLS BASED CURRICULUM – THE PROCESS

- Identify industrial skills
- Implement a successful skills development teaching strategy
- Include content (knowledge)
- Practice needed skills

IST AMATROL — AUTOMATED MANUFACTURING TECHNOLOGY

DESIGN PROCESSES 1 *
- Blueprint Reading
- Technical Drafting
- Basic CAD Software

MANUFACTURING PROCESSES 1 *
- CNC Mill Programming
- Tool Setup
- CNC Mill Operation
- Manual Machining

MATERIALS TECHNOLOGY *
- Material Properties
- Material Testing
- Strength of Materials
- Product Design Analysis

MEASUREMENT SYSTEMS 1 *
- Geometric Dimensioning and Tolerancing
- Precision Measurement
- Dimensional Gaging

MANAGEMENT SYSTEMS 1 **
- Process Planning
- Job Costing / Estimating
- Scheduling
- Total Quality Management
- MRP II

CONTROLS AND POWER DRIVES
(see Industrial Maintenance Flow Chart)

DESIGN PROCESSES 2 *
- CAD/CAM Software
- Design for Manufacturing
- Product Design

MANUFACTURING PROCESSES 2 *
- Tooling Selection
- Fixturing
- CNC Lathe/Mill Programming
- Canned Cycle Programming

MANUFACTURING PROCESSES 4 **
- Welding
- Finishing/Conditioning

MEASUREMENT SYSTEMS 2 **
- Statistical Quality Control ($\bar{X}$ and R)
- Quality Concepts
- Advanced Statistical Process Control
  - Capability Studies
  - Short Run SPC
  - P Charts

MANAGEMENT SYSTEMS 2 **
- Project Management
- Advanced Scheduling
- Databases
- Inventory Control
- MRP II

DESIGN PROCESSES 3 *
- CAD/CAM Software
- Mold Design

MANUFACTURING PROCESSES 3 *
- Plastics Operation/Setup
  - Injection Molding
  - Blow Molding
  - Extrusion Molding

MANUFACTURING PROCESSES 5 **
- Casting
- Forming Processes
- Forging/Sintering
- Rolling/Extrusion

MEASUREMENT SYSTEMS 3 **
- Vision Inspection Techniques
- Vision Applications
- System Interfacing
- Programming and Operation

FLEXIBLE MANUFACTURING SYSTEMS 1 *
- Advanced Servo Robot Programming
- Control Interfacing
- FMS Cell Development
- Network Communications
- Multitasking

FLEXIBLE MANUFACTURING SYSTEMS 2 **
- Non-Servo Robot Operation
- PLC-Robot Programming
- CNC-PLC Interfacing

DESIGN PROCESSES 4 *
- Facilities Design
- 3D CAD
- Solids Modeling

MANUFACTURING PROCESSES 6 **
- Composite Materials
- Advanced Plastics

AUTOMATIC IDENTIFICATION SYSTEMS **
- Barcode Systems
- RF ID Systems
- Operations, Setup
- Interfacing

COMPUTER INTEGRATED MANUFACTURING SYSTEMS **
- Systems Integration
- Inventory Systems
- MRP II to CIM System Link
- Pallet Transfer Lines

* = Curriculum in LAP format and Equipment complete. ** = Equipment is available but LAP format is not complete.

AMATROL®

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IST AMATROL™ ELECTRICAL MAINTENANCE TECHNOLOGY

ELECTRICAL FABRICATION 1 *
- Electrical Wiring Installation
- Sizing
- Component Installation

ELECTRICAL SYSTEMS 1 *
- AC Electricity
- DC Electricity

SERVO ROBOTICS *
- Servo Robot Operation
- Programming
- Discrete I/O Interfacing
- Applications

MECHANICAL TOOLS *
- Hand Tools Assembly
  - Wrenches, Screwdrivers
- Fasteners
- Files
- Precision Measurement
- Hand Power Tools

CONCEPTS OF MECHANICS *
- Force/Mass
- Friction
- Energy
- (6) Simple Machines

FLUIDPOWER SYSTEMS 1 *
- Basic Hydraulics
- Basic Pneumatics

PROCESS CONTROL 1 *
- Liquid Level Control
- Flow Control
- Valves, Sensors
- Process Quality Measurement
- PID Control

ELECTRICAL MACHINES 1 *
- DC Motors
- AC 1 ph Motors
- AC 3 ph Motors

MOTOR CONTROL SYSTEMS 1 **
- Relay Control Operation
- Start/Stop Control
- Troubleshooting
- Transformers
- Limit Switches, Pressure Switches, Liquid Level Switches

NON-SERVO ROBOTICS *
- Non-Servo Robot Programming
- Interfacing
- Applications

PROGRAMMABLE CONTROLLERS 1 *
- Programming
- Operation
- Discrete I/O Interfacing
- Discrete I/O Applications

MECHANICAL DRIVE SYSTEMS 1 *
- Motor Mounting/Alignment
- Key Fasteners
- Operation/Installation of
  - Chain Drives
  - V-Belt Drives
  - Spur Gear Drives
  - Couplings

FLUIDPOWER SYSTEMS 2 *
- Intermediate Hydraulics
- Intermediate Pneumatics
- Electro-Fluidpower
- Electronic Sensors

PROCESS CONTROL 2 *
- PH Control
- Material Safety Procedures
- Process Adjustments
- Analyze Material Quality

ELECTRICAL MACHINES 2 *
- Generators
- Alternators
- Wound Rotor Motors
- Synchronous Motors

MOTOR CONTROL SYSTEMS 2 *
- Timers/Counters
- Electronic Sensors
- Reduced Voltage Starting
- Motor Braking
- 3-Phase Transformers

SERVO DRIVES **
- Vector Drives
- AC Servo Drives
- DC Servo Drives
- Operation/Troubleshooting
- Setup

PROGRAMMABLE CONTROLLERS 2 *
- Analog I/O
- Troubleshooting
- Data/Math Operations
- Subroutines
- Message Displays

TRANSFER PUMP SYSTEMS 1 **
- Centrifugal Pumps
- Positive Displacement Pumps
- Metering Pumps
- Piping Networks

FLUIDPOWER SYSTEMS 5 **
- Proportional Valves
- Feedback Devices
- Speed/Position Control
- Maintenance/Troubleshooting

ELECTRICAL FABRICATION 2 *
- Conduit Bending
- Power Distribution
  - Bus Bars/Bus Plugs
- Circuit Protection
- NEC

MOTOR CONTROL SYSTEMS 3 *
- Variable Speed AC Drives
- SCR/TRIAC Drives
- Operation/Troubleshooting
- Interfacing

PROGRAMMABLE CONTROLLERS 3 *
- Process Control
- Networking, Fieldbus, Ethernet, Data Highway
- Remote I/O
- PID Control
- PLC Maintenance

TOTAL PRODUCTIVE MAINTENANCE
- Vibration Analysis
- Predictive Maintenance
- Preventive Maintenance
- Maintenance Management

* = Product Available ** = Product in Development

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IST AMATROL™ MECHANICAL MAINTENANCE TECHNOLOGY

CONCEPTS OF MECHANICS **
- Force/Mass
- Friction
- Energy
- (6) Simple Machines

MECHANICAL TOOLS *
- Hand Tools Assembly
  - Wrenches, Screwdrivers
- Fasteners
- Files
- Precision Measurement
- Hand Power Tools

READING TECHNICAL DRAWINGS *
- Multiview Drawings
- Isometric Drawings
- Sections, Assemblies
- Documentation
- Geometric Dimensioning and Tolerancing

TRANSFER SYSTEMS 1 **
- Centrifugal Pumps
- Turbine Pumps
- Pump Performance
- Pump Selection/Maintenance
- Pump Troubleshooting

FLUIDPOWER SYSTEMS 1 *
- Basic Hydraulics
- Basic Pneumatics
- Simulation Software

MECHANICAL DRIVE SYSTEMS 1 *
- Motor Mounting/Alignment
- Key Fasteners
- Operation/Installation of
  - Chain Drives
  - V-Belt Drives
  - Spur Gear Drives
  - Couplings

MECHANICAL DRIVE SYSTEMS 2 *
- Lubrication
- Maintenance/Selection
  - Couplings
  - Chain Drives
  - V-Belt Drives
  - Gear Drives
- Advanced Drive Types

MATERIALS AND PROCESSES 1 *
- Basic Fabrication
- Drill Press
- Lathe
- Mill
- Grinder
- Material Identification
- Strength of Materials

TRANSFER SYSTEMS 2 **
- Plunger-Type Pumps
- Diaphragm Pumps
- Magnetic Pumps
- Peristaltic Pumps

FLUIDPOWER SYSTEMS 2 *
- Intermediate Hydraulics
- Intermediate Pneumatics
- Electro-Fluidpower
- Electronic Sensors

MECHANICAL DRIVE SYSTEMS 3
- Operation/Installation/ Maintenance
  - Bearings, Roller, Ball, Plain
- Seals/Gaskets
- Gearboxes
- Right Angle Gears

MECHANICAL DRIVE SYSTEMS 4 **
- Conveyors
- Linear Drives
- Clutches/Brakes
- Ball Screws

PIPING SYSTEMS **
- Installation/Maintenance
- Metal Piping, Plastic Piping
- Metal Tubing Hose
- Valves, Filters

TRANSFER SYSTEMS 3 **
- Multistage Pump Systems
- Parallel Pump Systems

FLUIDPOWER SYSTEMS 3 *
- Advanced Hydraulics
- Advanced Pneumatics

TOTAL PRODUCTIVE MAINTENANCE **
- Vibration Analysis
- Predictive Maintenance
- Preventive Maintenance
- Maintenance Management

RIGGING SYSTEMS **
- Safety
- Hand Signals
- Worm Hoists
- Textile/Metal Rope
- Chain
- Load Calculation

CENTRAL LUBRICATION SYSTEMS **
- Gear Pump Systems
- Single Line Systems
- Progressive Systems
- Maintenance/Troubleshooting
- Installation/Selection

STEAM SYSTEMS **
- Traps
- Generation
- Safety
- Valves
- Maintenance/Troubleshooting
- Insulation

FLUIDPOWER SYSTEMS 4 **
- Hydraulic Maintenance/ Troubleshooting
- Pneumatic Maintenance/ Troubleshooting
- Hydraulic System Construction
- Pneumatic System Construction

FLUIDPOWER SYSTEMS 5 **
- Proportional Valves
- Feedback Devices
- Speed/Position Control
- Maintenance/Troubleshooting

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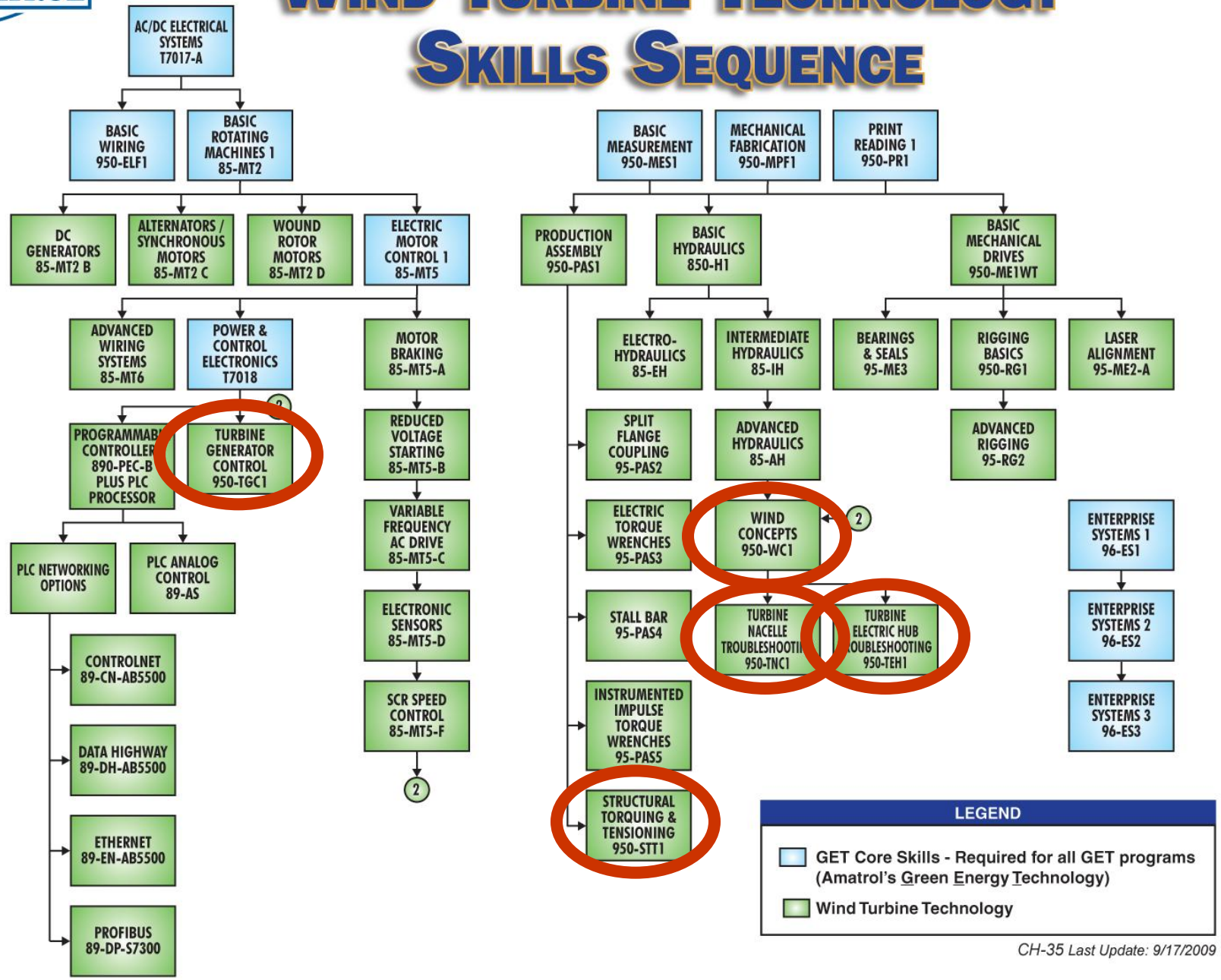
“Core” Technology Skills For “Wind”

- Many similar skills as taught in Industrial Maintenance
- Electrical
- Mechanical
- Fluid Power
- Electrical Fabrication (wiring, etc.)
- Mechanical/Hydraulic Fabrication
- Structural torquing & tensioning

AMATROL'S "GREEN" DEVELOPMENT

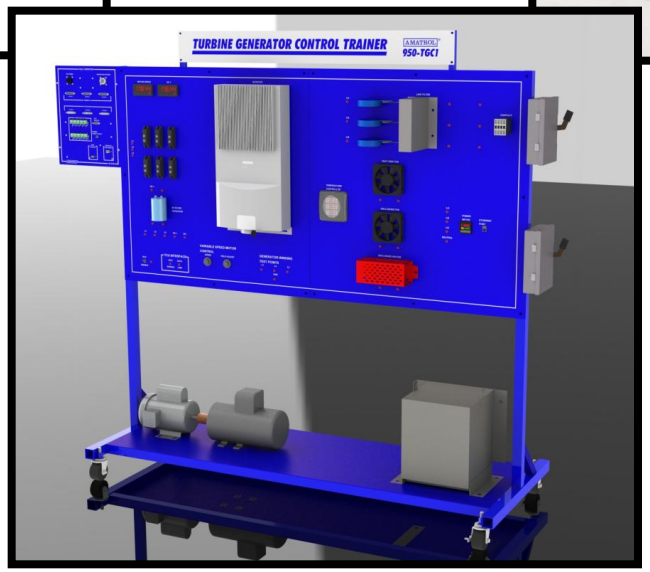
- Utility Level Wind Technicians
- Commercial/Residential Solar Technicians
  - Solar Photovoltaic Installation/Maintenance
  - Solar Thermal/Installation/Maintenance

Wind Turbine Technology Skills Sequence



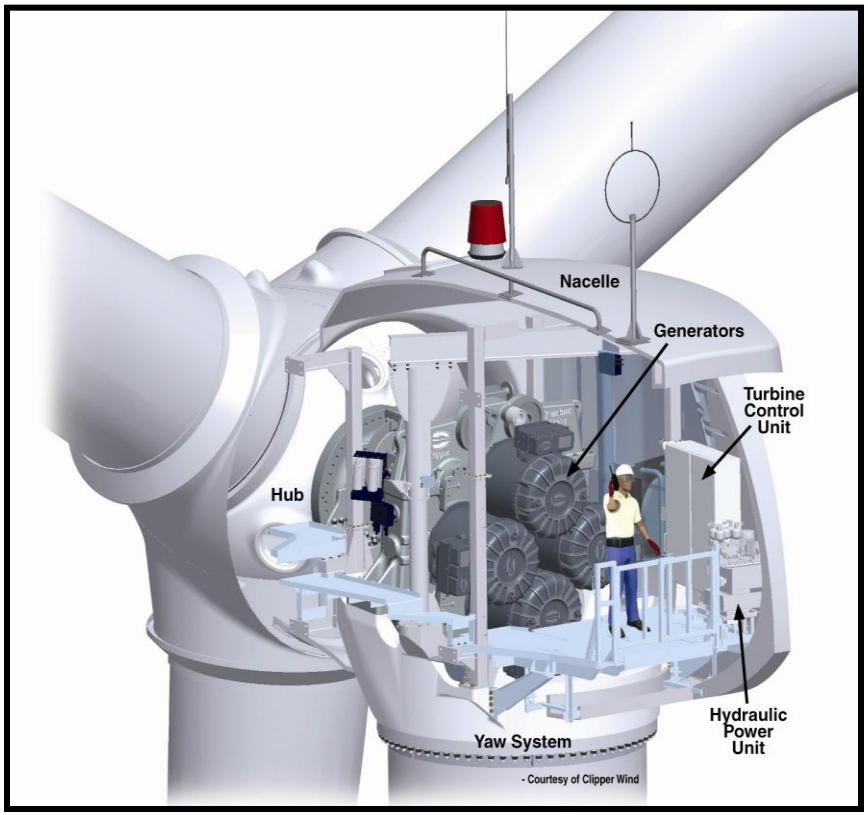
CH-35 Last Update: 9/17/2009

Amatrol's New Line of Wind Turbine Learning Systems



Turbine Nacelle Troubleshooting Learning System

The Nacelle Troubleshooting Learning System replicates a full size, utility-scale wind turbine.



Nacelle Curriculum

- Multimedia Format with Instructor Guide
  - 6 Modules
- Skills Learned
  - Functions and operations of the TCU
  - Functions of the Hydraulic Power System
  - Yaw Brake, Parking Brakes, Rotor Lock and lubrication
  - Addresses the Yaw Drive and its functions (i.e., Cable Twist Box)
  - Addresses Safety Protection, Speed Measurements and Communications
  - Addresses fault messages, hydraulic, yaw, and turbine control troubleshooting

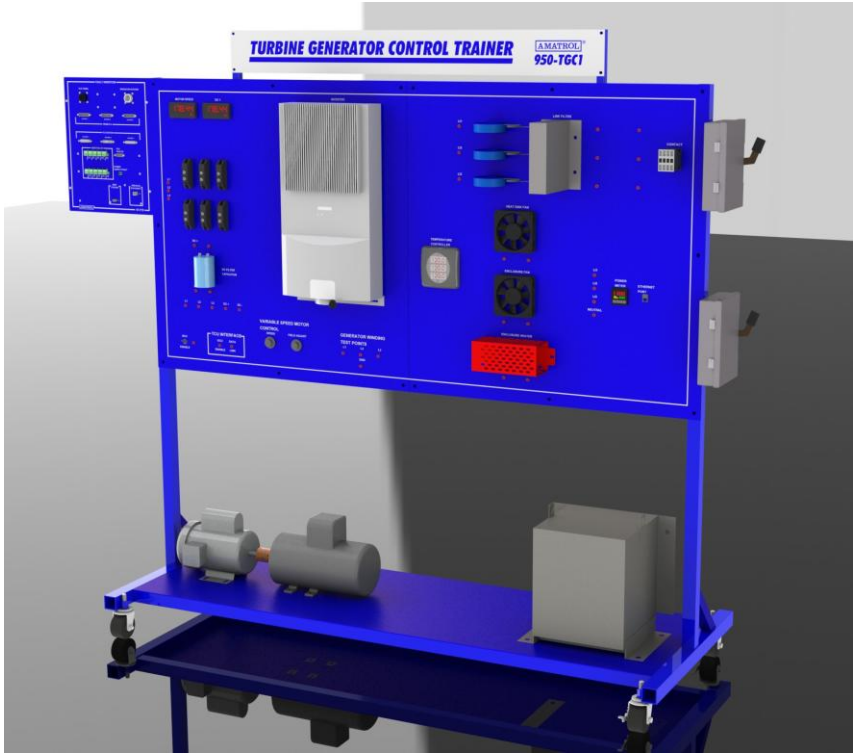
950-TEH1 Turbine Electric Hub Troubleshooting Learning System

Hub Curriculum Features

- Multimedia Format with Instructor Guide
- 4 Modules
- Skills Learned
  - Pitch Control System Operation
  - Commissioning/ Operational Tests
  - Setup and Adjustment of System
  - Use HMI software Operation
  - Manual Operation
  - Safety
  - Troubleshooting

Turbine Generator Control Learning System

- Includes:
  - Mobile Workstation
  - Computer-based Fault Insertion
  - Inverter Unit w/Contactors
  - Controller w/Discrete and Analog I/O
  - Network Communications Interface
  - Signal Conditioners
  - Circuit Disconnects
- Operates separately or can tie into hub and turbine trainers through fiber optics



950-STOL1/950-STCL1/950-STF1 SOLAR THERMAL SYSTEMS

950-STOL1

950-STCL1

950-STF1

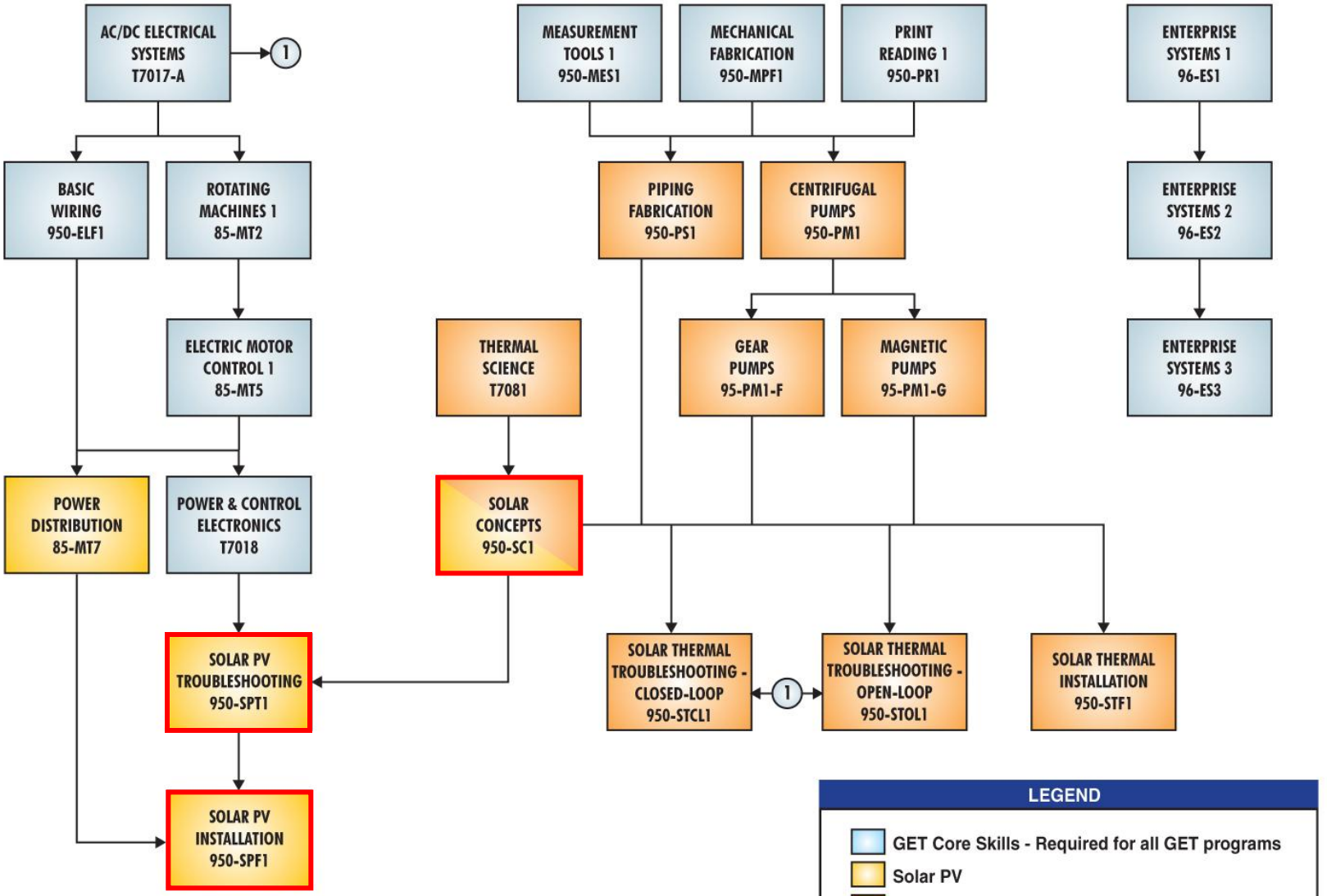
Solar PV Systems

950-SPT1 Solar PV Troubleshooting Learning System

“Core” Skills for Solar Thermal and PV Technicians

- Basic Thermal Systems
- Basic Electricity
- Electrical Wiring
- Basic Plumbing (fabrication)
- Measurement
- Pumps

SOLAR TECHNOLOGY SKILLS SEQUENCE



CERTIFICATION - AMATROL PARTNERS WITH

- NIMS
- MSSC
- AWEA
- ETA
- NABCEP

American Wind Energy Association

- Skill Sets for Utility Scale Wind Turbine Technicians — entry level
- Approval of Wind Technician Programs

ETA International

- Alternative Energy Installer
- Alternative Energy Integrator
  - Entry level
  - Mid level
  - Advanced level

WORKFORCE PRESSURES FOR WIND INDUSTRIES

- 50% + Wind related manufacturing – high level skills
- Wind Turbine Installation/Maintenance – high level skills
- Wind industry growth in Indiana – high numbers
- The career “Lifetime” of Turbine Technicians is limited – high numbers
- Current workforce needs for manufacturing – high level skills

STRATEGIES FOR WORKFORCE DEVELOPMENT

- Emphasize the need for technical training at all levels of education
- Promote the development of “core” skill sets for career longevity/flexibility
- Promote articulation/dual credit tracks for secondary to post-secondary
- Re-tool un and underemployed workers for renewable careers
- Emphasize the need for transportable certifications for all workers

BARRIERS TO CLEAN ENERGY WORKFORCE DEVELOPMENT

- Public perception of manufacturing
- Investment of resources – clean generally costs more at the outset
- Encourage the public to “sacrifice” – make lifestyle changes.
- Conservation has to be a part of the solution, not just more energy production

QUESTIONS ???